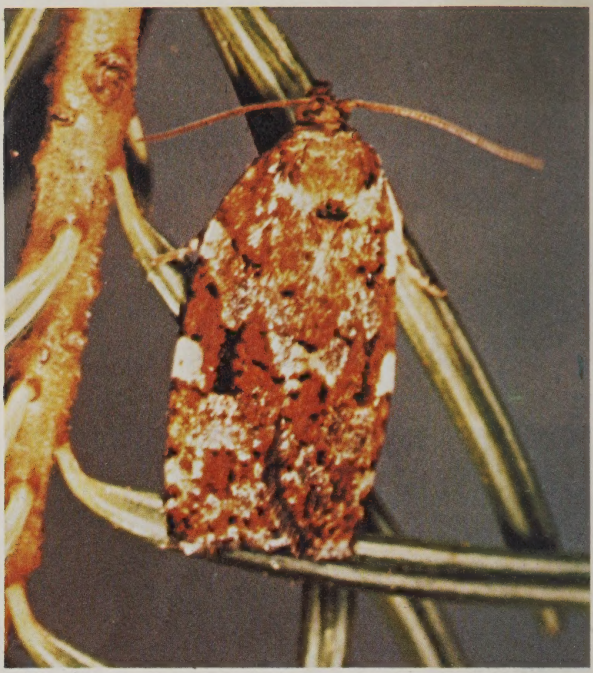
WESTERN SPRUCE BUDWORM

MAJOR DEFOLIATOR OF CONIFEROUS TREES

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE • NORTHERN REGION



Adult western budworm moth, resting on fir needles.

The Insect

To entomologists, the western spruce budworm is *Choristoneura occidentalis* Freeman. The adult is a mottled, buff-colored moth, about three-fourths of an inch long. Like many insects, the western spruce budworm has four stages of development: (1) egg, (2) larva, (3) pupa, and (4) adult moth.

CATERPILLAR

As tiny caterpillars, budworms spend the colder months in a silken cocoon under bark scales and other sheltered spots on host trees. In late May and early June, they move out to find food. They usually feed on new foliage until mid-July. If tree buds have not begun to grow, the caterpillars mine inside old needles. By July the caterpillar has grown from the size of a pinhead to about one inch in length.

MOTH

During mid-July, the caterpillars web needles together and go into the pupal or resting stage. They remain in the pupal stage for 10 to 12 days, then emerge as moths. Females are usually too heavy to fly far, so most of the eggs are laid on

nearby foliage. Female moths lay 10 to 50 eggs per mass. The pale green eggs overlap one another, somewhat like fish scales. Larvae hatch from eggs in about 10 days. New caterpillars hibernate almost immediately, thus completing the life cycle.

History

The budworm is native to this continent. It was first detected in the West about 1915. Until 1942 budworm outbreaks were of short duration in National Forests of the Northern Region. Outbreaks subsided from natural factors and caused little tree mortality. In 1942, an 8-year outbreak started in the Bob Marshall Wilderness of Montana and spread over 200,000 acres. Tree mortality was extensive.

Since 1950, budworm outbreaks have been more frequent. More than 4½ million acres of Douglas-fir type forests were heavily infested in southwestern Montana by 1958. The infestation was reduced by aerial spraying but 2 million acres in the Northern Region were still infested in 1963.

Infestations appeared west of the Continental Divide in the early sixties. In 1968, 4.2 million acres showed evidence of damage. Budworm infestations now extend west from Montana's Stillwater River, south to the Salmon River in Idaho, and northeast form Riggins, Idaho, to the Vermillion River in Montana. A total of approximately 3.2 million acres of State, private and National Forest lands are now infested.

INVADE NEW AREAS

Budworms invade new areas when they fly during the last part of July. Moth flight occurs during late afternoon and evening. City lights often attract great swarms of moths. Winds and updrafts can transport moths as far as 50 miles. First and second instars can also be tranported by winds.

What It Does

In Montana and Idaho, the budworm prefers grand fir, Douglas-fir, subalpine fir, and Engelmann spruce. They feed to a lesser extent on western larch, lodgepole, ponderosa and western white pines and western hemlock.

Full-grown western budworm caterpillar, feeding on new fir needles.

Pupal resting stage of western budworm. Cocoon of webbed needles, opened up to reveal insect.

Egg mass of western budworm along fir needle.

TREE MORTALITY

While caterpillars emerging in the spring may mine old needles, they prefer new growth. Successive years of feeding on new growth may cause tree mortality. Continuous light feeding reduces growth and weakens trees and can make trees susceptible to attack by bark beetles and decay fungi. Young trees usually die first.

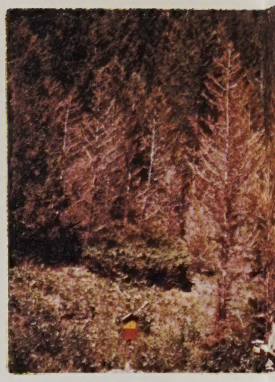
SEED LOSS

Studies, from 1967 to 1969, showed the budworm was damaging Douglas-fir cones in eastern Montana. In one area, examination revealed larvae damaged more than 70 percent of the cones. In western Montana western larch cones and seeds are sometimes completely destroyed. Loss of seeds can severely curtail natural reforestation.

Western budworm caterpillars can sever stems of sapling-size western larch shoots, producing multiple leaders and crooked boles. Heavy budworm feeding destroys the value of Douglas-fir and other species for Christmas trees. Defoliation reduces the esthetic value of trees in recreational areas.

Stand of Douglas-fir in eastern Montana which has been heavily defoliated by western budworm for several years. Brownish trees are dead.

Collecting Douglas-fir foliage to sample number of western budworm egg masses.



Assessment of bud

What Is Being Done?

Surveys: Maps, based on annual aerial surveys, show extent and degree of budworm defoliation, and provide accurate records of infestations. Budworm populations are evaluated by collecting branches from infested areas and counting egg masses. The number of egg masses (per 1,000 square inches of foliage) are used to predict next year's defoliation.

Research: Basic research is being conducted on the relationship between the budworm and its various hosts, the variety of budworm species, their eating habits, and the different impacts of budworm damage, as well as factors that may limit infestations.

Environmental Statement Preparation: The National Environmental Policy Act requires the Forest Service use all practical means and measures—in a manner calculated to foster and promote the general welfare—to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social and economic requirements for present and future generations. The objective of preparing an Environmental Impact Statement is to provide careful and thorough consideration in the planning and decision-making process regarding environmental considerations. During the winter of 1977, an Envoronmental Impact Statement on the western Spruce Budworm in the Northern Region is being processed to assist decision makers and

worm infestation.

Timber harvested to salvage budworm-dam

resource managers in determining which alternative or combination of alternatives should be used in dealing with specific budworm problems. Public input is an integral part of this process.

Management Alternatives:

Continue Present Management: This involves accepting the consequences of budworm defoliation and relying on natural factors to end outbreaks. Parasites, predators, diseases, adverse climatic conditions and starvation all affect budworm populations. In the western United States, there are about 35 species of primary parasites—including wasps and flies—that kill the budworm. Spiders, ants, beetles and many birds feed on budworms. A few bacteria and viruses kill the insect. Under this alternative, land managers would continue to monitor growth loss and mortality and periodically survey the effects on age class and species distribution as well as impacts on other resources.

Silvicultural: Harvesting budworm infested trees may reduce the insect populations. Patch clearcutting in small cutting units, followed by burning, will favor pine production over firs thus preventing or reducing budworm infestations. Trees genetically resistant to the budworm may be a silvicultural alternative for resource managers in the future.

Chemical Application: Insecticides, sprayed

ged trees.

Application of Sevin 4-Oil.

from the air, were, in the past, the most effective method of reducing western spruce budworm infestations. Currently, two registered pesticides are available for budworm management. Malathion, an organic phosphate, is toxic to many species of insects and persists for about 7 days under normal field conditions. Sevin-4-Oil, a carbamate material is registered for management of the Western Spruce Budworm. It is also toxic to many other insects. It persists for about 14 days under field conditions. Other nonpersistent insecticides and biological agents are being investigated and tested.

A new chemical, Orthene, shows promise. It has been tested by the Forest Service for five years to determine its impact on fish, wildlife, and other nontarget organisms. Tests show Orthene poses little hazard to birds, fish and mammals, either at the time of application or after prolonged periods of exposure. Neither Orthene nor its breakdown products have been found to accumulate in any organisms examined from single-celled plants and animals to larger mammals and birds.

A biological agent known as *Bacillus thuringiensis*, a bacterium, has been tested in Canada for several years. Aerial applications have demonstrated that is can cause budworm larvae mortality at rates high enough to suggest the possibility of using it for budworm management.

Aerial sprays, to be effective, would be applied in early July in Montana and Idaho, when 95 percent of the budworm caterpillars are in their third, fourth, fifth, and sixth stages of development and would be most vulnerable.

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